

Treatment Outcomes of Long-Pulsed Nd:YAG Laser for Two Different Subtypes of Rosacea

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ABSTRACT

Background: A variety of lasers have been used for the treatment of rosacea. However, treatment of this condition with long-pulsed neodymium-doped yttrium aluminium garnet laser has not been reported yet. **Objective:** To assess the efficacy and safety of long-pulsed neodymium-doped yttrium aluminium garnet laser in two different subtypes (erythematotelangiectatic and papulopustular) of rosacea. **Methods:** A total of 66 patients were enrolled in the study. All of the patients were treated with long-pulsed neodymium-doped yttrium aluminium garnet laser with 3- to 4-week intervals. Rosacea severity score was assessed by using photographs. Improvement in severity was defined as the percentage reduction in severity scores from baseline to the end of treatment. Patients were also asked about their own opinions of improvement at the end of the treatment. Side effects were also documented. **Results:** Good to excellent improvement was achieved in up to 50 percent of the patients in the erythematotelangiectatic and papulopustular groups. Percent improvement of global severity was significantly greater in the erythematotelangiectatic patients than in the papulopustular patients. The majority of patients from both groups noted a significant improvement of the lesions. Hypopigmented atrophic scars were seen in two patients. **Conclusion:** The long-pulsed neodymium-doped yttrium aluminium garnet laser is a safe and effective treatment for vascular and inflammatory lesions of rosacea. (*J Clin Aesthet Dermatol.* 2015;8(9):16–20.)

Rosacea is a chronic inflammatory cutaneous disorder with periods of exacerbations and remissions. Clinical findings are characterized by flushing, erythema, telangiectasia, papules, and pustules. There are four recognized subtypes—erythematotelangiectatic (ETR), papulopustular (PPR), phymatous, and ocular.¹ Although angiogenic and sebaceous factors have been implicated in the etiopathology of the disease, it remains unclear. Vascular abnormalities, dermal matrix degeneration, environmental factors, and microorganisms may have a potential role in the development of rosacea.²

Rosacea may significantly affect patients' lives, leading to considerable psychological and social distress over appearance. Therefore, management of this condition is very important. There is no definite cure. Electrosurgery and lasers can be used to decrease vascular lesions.³ Topical and/or oral antibiotics can be used to suppress the inflammatory lesions. Although these methods are moderately successful in controlling symptoms, relapse usually occurs shortly after the cessation of therapy.^{4,5}

Many types of lasers and light devices have been increasingly used in the treatment of rosacea. However, the role of long-pulsed neodymium-doped yttrium aluminium

garnet (Nd:YAG) laser in this condition has not been well-studied. In this study, the authors assessed the efficacy of long-pulsed Nd:YAG laser in treating patients with two different subtypes (ETR and PPR patients) of rosacea.

MATERIALS AND METHODS

A total of 66 patients, who were diagnosed to have ETR and PPR subtypes of rosacea in the authors' outpatient clinic, were recruited. Demographic features, skin types, and clinical findings of each patient were recorded. Patients who had received oral antibiotics and/or oral retinoids within 12 months, were pregnant, were nursing, had a history of photosensitivity, or were on anticoagulation therapy were excluded from the study. This study was approved by the ethics committee of the authors' hospital. The procedure was explained fully to each patient, and informed consent was obtained. Patients with ETR and PRP subtypes were analyzed separately according to clinical symptoms and signs.² "Rosacea severity score" of each patient was calculated according to the distribution and number of lesions (Table 1).⁶

Laser treatment. The entire face of each patient

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TABLE 1. Assessment of “rosacea severity score” for erythematotelangiectatic and papulopustular patients

SCORE (RATING)	DESCRIPTION FOR ERYTHEMATOTELANGIECTATIC ROSACEA	DESCRIPTION FOR PAPULOPUSTULAR ROSACEA
0 (none)	Either no visible erythema or minimal residual erythema/telangiectasia	Almost no rosacea (no papules and/or pustules) and/or residual erythema/telangiectasia
1 (mild)	Slight erythema/telangiectasia either centrafacial or generalized to whole face	Rare papules and/or pustules: residual to mild erythema/telangiectasia
2 (moderate)	Pronounced erythema/telangiectasia either centrafacial or generalized distribution	Pronounced number of papules and/or pustules: moderate erythema/telangiectasia
3 (severe)	Severe erythema/telangiectasia with a red to purple hue either centrafacial or generalized distribution	Numerous papules/pustules: severe erythema/telangiectasia

was treated with long-pulsed Nd:YAG laser (FOTONA Dualis[®], Skinlight Laser, 1064nm, Slovenia) with 2 to 3mm spot size, 100 to 160J/cm², 15 to 20msn pulse durations. During exposure to the laser, an air cooler (Cryo 5, Zimmer Medizinsysteme GmbH, Neu-Ulm, Germany) at a cooling level of 3 to 5°C was used for epidermal protection and for decreasing pain. Postoperatively, an epithelizing cream was applied to the treated areas, and a sunscreen cream was recommended for all patients. The sessions were applied with 3- to 4-week intervals.

Assessment of treatment. Photographs of all lesions were taken by the same person at the beginning of the therapy and later before and after each treatment session. Treatment protocols received by 66 patients were variable. In the ETR group, the number of treatments were varied between two and eight. On the other hand, in the PPR group, they were between one and 10. Rosacea severity score was assessed by using the photographs taken at the beginning and four weeks after the last treatment. Percent improvement of global severity was determined by the percentage reduction of severity scores between the first and last assessment; <25-percent improvement (poor); 25- to 50-percent improvement (fair); 51- to 75-percent improvement (good); >75-percent improvement (excellent).

In addition, patients were asked to rate the subjective improvement in their lesions by using a scale between one and four; where 1 meant poor improvement; 2, slight improvement; 3, much improvement and 4, excellent improvement. Patients were evaluated for side effects after each treatment session.

Statistical analysis. All statistical analysis was carried out using SPSS version 17.0. Wilcoxon signed test was used for nonparametric variables, to compare pre- and post-treatment severity scores. Kolmogorov-Smirnov test was used to compare the reduction in severity scores between the two groups. Physician assessment and patient satisfaction between the two groups were analyzed

TABLE 2. Demographic features of the patients

ROSACEA SUBTYPE	ETR	PPR
Number of patients	39	27
Rosacea severity score		
None	0	0
Mild	12	7
Moderate	9	10
Severe	18	10
Mean age – years (range)	47.43 (27–78)	46.48 (24–66)
Sex		
Women	29 (74.36%)	15 (55.56%)
Men	10 (25.64%)	12 (44.44%)
Duration of the disease (years)	13.31 (1–37)	5.7 (6m–20y)
Skin type		
II	26 (66.67%)	16 (59.26%)
III	13 (33.33%)	11 (40.74%)

using the Mann-Whitney U test. Statistical significance was defined as $P < 0.05$.

RESULTS

The study included 22 male and 44 female patients with a mean age of 47.05 years (range 24–78 years). The mean duration of rosacea was 10.20 years. There were 39 patients in the ETR group and 27 patients in the PPR group. All of the patients had Fitzpatrick skin type II or III. Demographic features of the patients are shown in Table 2. The mean number of treatment sessions was 3.97 for all

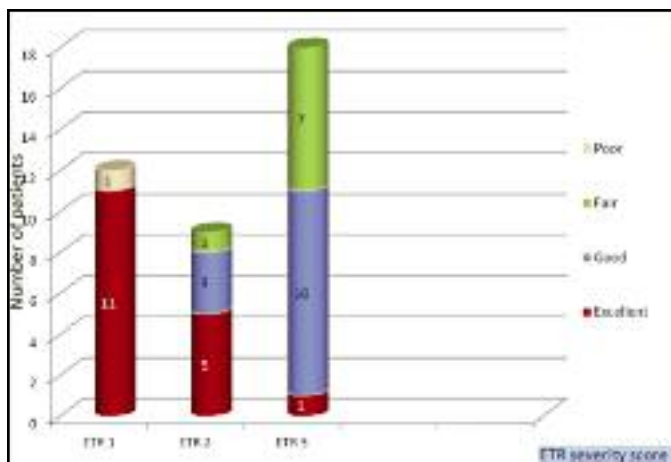


Figure 1. Distribution of the patients according to “rosacea severity score” and the reduction in severity scores (exchange ratio) of patients with ETR.

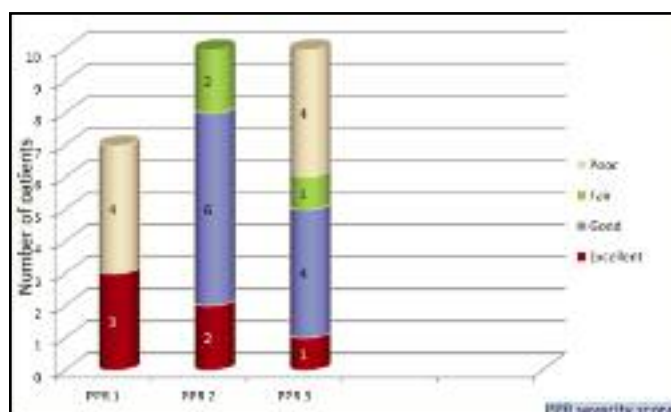


Figure 2. Distribution of the patients according to “rosacea severity score” and the reduction in severity scores (exchange ratio) of patients with PPR.

patients; 3.95 in the ETR group (range 2–8), and 4.33 in the PPR group (range 1–Kolmogorov-Smirnov test 10).

The distribution of the patients according to “rosacea severity scores” and the reduction in severity scores (exchange ratio) of the two groups are shown in Figures 1 and 2. In the ETR group, the reduction of severity scores was significantly different for all types of rosacea ($P < 0.05$); the reduction was most significant in the mild form of ETR (ETR-1) (91.70%) (Figure 3). In the PPR group, the reduction in rosacea severity scores was significantly different in the moderate and severe forms (Figure 4).

The improvements in treatment of both groups are shown in Table 3. Percent improvement of global severity of laser therapy was 79.49 percent in the ETR group and 62.96 percent in the PPR group. Percent improvement of global severity treatment success was significantly greater in ETR patients than that of PPR patients ($P = 0.020$).

More than 50 percent of the patients reported either much or excellent improvement. Patient satisfaction was higher in the ETR group than that in the PPR group

($P = 0.047$) (Table 4).

Hypopigmented atrophic scars were seen in two patients after laser therapy.

DISCUSSION

The management of rosacea has to be tailored to each subtype of the disease. These different subtypes are probably caused by divergent pathogenic factors. Passive vascular dilatation was suggested in the pathogenesis of erythema and telangiectasia seen in rosacea patients. This vascular instability is caused by the leakage of fluid and inflammatory mediators into the dermis, and it may result in the development of papules and pustules.^{4,7} Laser treatment is thought to exert its effects in several ways, including ablation of vascular anomalies, reorganization and remodeling of dystrophic dermal connective tissue, and also interruption of the release of inflammatory mediators.^{7,8} Some authors suggested that laser therapy for rosacea destroy small vessels, reducing the unpleasant symptoms of sensitive skin.⁹

Despite the numerous reports in the literature of using pulsed-dye laser (PDL, 585nm), potassium titanyl phosphate laser (KTP, 532nm), and intense pulsed light (IPL, 500–1200 nm)⁷ for the treatment of rosacea, to our knowledge the effects of long-pulsed Nd:YAG on rosacea have not been studied yet.^{10,11} The authors studied the efficacy of Nd:YAG laser in patients with ETR and PPR rosacea in this present study. Nd:YAG laser was effective for both erythema and papules. Patients with vascular lesions responded better to treatment by Nd:YAG than those who had papules. ETR group had better improvement than PPR. Subjective assessment of the patients regarding the improvement in the lesions correlated with the assessment of physicians.

The PDL therapy was found to be moderately effective in vascular lesions of rosacea.^{3,12–14} It has also been suggested that decreasing erythema and telangiectasia lead to a decrease in flushing symptoms.¹⁵ One of the earlier studies using PDL for vascular lesions of rosacea was carried out by Lowe et al.¹⁶ In this study, good and excellent results were achieved in reduction of erythema and telangiectasia in 85 percent of the patients after 1 to 3 sessions. Clark et al.¹² also found a reduction in inflammatory lesions after PDL treatment. The only study using PDL for inflammatory lesions was carried out by Berg et al.¹⁷ They reported that PDL had limited efficacy on PPR lesions of rosacea. In the authors' study, more than half of the patients in the PPR group had moderate and strong reduction in severity scores after a mean of four sessions. This might indicate the beneficial effect of Nd:YAG laser on inflammatory lesions of rosacea. One of the theories of PPR lesions of rosacea proposed is that *Demodex* mites induce perifollicular inflammation.^{1,4} The destruction of the follicular unit by Nd:YAG laser might be the reason why Nd:YAG laser showed more success than the other laser devices in the treatment of papules and pustules.

The IPL has been used for treating vascular skin lesions.¹⁸ The studies using IPL for rosacea treatment have

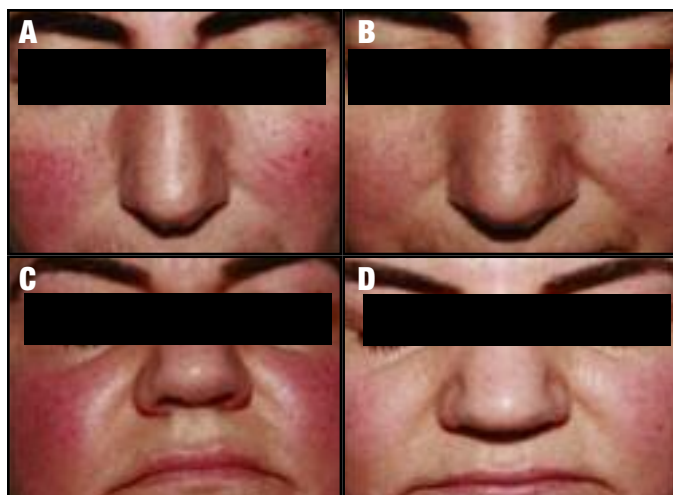


Figure 3. (A) The lesions of a female patient with ETR before treatment; (B) The lesions of the same patient after six sessions of laser treatment; (C) The lesions of a female patient with ETR before treatment; (D) The lesions of the same patient after two sessions of laser treatment.



Figure 4. (A) The lesions of a male patient with PPR before treatment; (B) The lesions of the same patient after five sessions of laser treatment; (C) The lesions of a female patient with PPR before treatment; (D) The lesions of the same patient after three sessions of laser treatment.

reported good to excellent results.^{19,20} Mark et al²¹ used scanning laser Doppler for measuring blood flow and found that IPL was effective for reducing rosacea-associated blood flow, telangiectasia, and erythema. Neuhaus et al²² compared PDL with IPL in 29 patients with rosacea and achieved similar successful results. They indicated that the average number of treatments for rosacea should be three in order to achieve maximum improvement.²² The KTP laser is effective for superficial vascular lesions because of its wavelength.²³ Maxwell et al²⁴ reported a greater improvement in rosacea signs by using KTP laser together with topical retinaldehyde.

In this study, the authors' determined good to excellent improvement of lesions in rosacea patients. The previous studies using other lasers demonstrated similar results. Nonetheless, these lasers have many disadvantages. The PDL deposits a large amount of energy in a short period of time, often leading to vessel rupture and purpura formation. Although KTP allows for a slower, gentler heating, coagulation, and collapse of the vessel, it is not effective for deeper vessels.²⁵ IPL devices have a wideband light source with a spectrum ranging from 500 to 1200nm. The choice of correct parameter selection is essential. The longer wavelengths must be used for deeper penetration into the skin. High doses of energy may lead to formation of bulla, scars, and depigmentation. These side effects can be controlled by decreasing fluence or increasing pulse duration; however, in this situation, clinical effects may diminish.^{8,16,18} Previous studies have shown that 1064nm Nd:YAG lasers used at longer pulse widths can be used to treat vascular lesions. Nd:YAG lasers can penetrate deeply and enable treatment of deeper vessels. Because of lower melanin absorption with Nd:YAG lasers, there is less concern for epidermal damage, and they may be more

TABLE 3. Physician's assessment of treatment success

TREATMENT SUCCESS	ETR (%)	PPR (%)	P VALUE*
Poor	1 (2.56)	8 (29.62)	
Fair	8 (20.51)	3 (11.11)	
Good	13 (33.33)	10 (37.03)	
Excellent	17 (43.58)	6 (22.22)	0.020

*Mann Whitney U test

TABLE 4. Patients' rating of treatment improvement

TREATMENT SUCCESS	ETR (%)	PPR (%)	P VALUE*
No improvement	—	2 (7.40)	
Slight improvement	2 (5.12)	6 (2.22)	
Much improvement	13 (33.33)	7 (25.92)	
Excellent improvement	24 (61.53)	12 (44.44)	0.047

* Mann Whitney U test

safely used to treat patients with darker skin. Compared to other lasers, the risk for postinflammatory hyperpigmentation is very low.²⁶

In conclusion, this is the first study where long pulsed Nd:YAG laser was used for the treatment of vascular and inflammatory lesions of rosacea. The authors found that Nd:YAG laser was very successful in rosacea patients, and the effect among ETR patients was greater than PPR patients. The majority of patients from both groups noted a significant improvement of their lesions. Hypopigmented atrophic scars were documented in only two patients. Other side effects, such as purpura, bullae, bruising, and hyperpigmentation were not seen. Long-pulsed Nd:YAG laser seems to be effective and safe for the treatment of vascular and inflammatory lesions of rosacea. It may be used as first-line therapy in the early stages of ETR. In PPR patients, it may be combined with oral/topical antibiotics. Further research is needed to assess the long-term effects of long-pulsed Nd:YAG lasers in the treatment of rosacea and to compare Nd:YAG with other laser devices.

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